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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/935,776	08/22/2001	Charles M. Lieber	H00498.70054/TJO/DPM	8935
23628	7590	08/30/2005	EXAMINER	
WOLF GREENFIELD & SACKS, PC FEDERAL RESERVE PLAZA 600 ATLANTIC AVENUE BOSTON, MA 02210-2211			HU, SHOUXIANG	
			ART UNIT	PAPER NUMBER
			2811	

DATE MAILED: 08/30/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/935,776

Applicant(s)

LIEBER ET AL.

Examiner

Shouxiang Hu

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 20 June 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) See Continuation Sheet is/are pending in the application.
- 4a) Of the above claim(s) See Continuation Sheet is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) See Continuation Sheet is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>6/20/05</u> . | 6) <input type="checkbox"/> Other: _____ |

Continuation of Disposition of Claims: Claims pending in the application are 1-31,38-47,49-72,75,76,97,98,102-105,109-111,113-116,118-201,261,262 and 374-377.

Continuation of Disposition of Claims: Claims withdrawn from consideration are 3,4,9-31,49-55,102-105,109,111,113-116,121-174,176-180,182,184,185,190,192,193,196-201,261,262 and 334-373.

Continuation of Disposition of Claims: Claims rejected are 1,2,5-8,38-47,56-72,75,76,97,98,110,118-120,175,181,183,186-189,191,194,195 and 374-377.

DETAILED ACTION

Pending Claims

1. According to the latest amendment (June 20, 2005) and in view of the previous office action, claims 1-31, 38-47, 49-72, 75-76, 97-98, 102-105, 109-111, 113-116, 118-201, 261-262 and 374-377 are pending in this application. Among them, claims 3, 4, 9-31, 49-55, 102-105, 109, 111, 113-116, 121-174, 176-180, 182, 184, 185, 190, 192, 193, 196-201, 261, 262 and 334-373 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention; and, claims 1, 2, 5-8, 38-47, 56-72, 75, 76, 97-98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195 and 374-377 remain active in this office action.

Claim Objections

2. Claims 1, 2, 5-8, 38-47, 56-72, 75, 76, 97-98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195 and 374-377 are objected to because of the following informalities and/or defects:

These claims each recite the combined subject matters that the recited electrical component comprises at least four semiconductors assembled together in electrical communication and that the making the of the recited device includes the step of selecting four nanowires having a variation in individual average diameter of less than 20% as the recited four nanowires in the recited device; however, the original disclosure lacks an adequate description regarding these subject matters. It is not clear how such

selection process is implemented and how the diameters are measured for each of the nanowires before they are chosen for forming the recited component.

Furthermore, these claims each recite the subject matters of an electrical component comprising at least four semiconductor nanowires assembled together in electrical communication; but they fail to define what are the physical and/or positional relationships between them and/or individual functionalities for them.

In addition, these claims each recite the subject matters of "individual average diameter", but it is not clear whether such "individual average diameter" is defined as an average diameter at an individual cross-section of an individual nanowire, or as an average diameter averaged for all the cross-sections along the entire individual nanowire.

Claims 2, 47 and 118-120 each fail to clarify what is the relationship between the semiconductor nanowire recited in these dependent claims and the one already recited in their corresponding independent claims.

Claims 43-47 and 58-61 each recite the subject matters regarding the length/diameter ratios of the semiconductor nanowires in a component that has at least four such semiconductor nanowires, but the original disclosure lacks an adequate description regarding what the length/diameter ratios should be in such a component having four such nanowires. And, applicant's 06-20-2005 amendment fails to point out where in the specification such ratio limitations in a component structure (rather than in a free-standing state) are disclosed and/or discussed.

Claims 62-67 are further objected to as claim 56 already recites that the largest cross-section is less than 50 nm.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

3. Claims 1, 2, 5, 38-47, 56-72, 75, 76, 97-98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195 and 374-377, as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 102(e) as being anticipated by Kuekes et al. ("Kuekes"; US 6,559,468; of record).

Kuekes discloses an electrical device (Figs. 6 and 7), comprising more than four nanowires forming more than four field effect transistors (Fig. 6), each of them comprises: a doped semiconductor (14) having a diameter as small as less than 5 nm (see col. 4, lines 52-54). And, it further includes an exterior sell (22). Furthermore, it is noted that the four nanowires are in electrical communication as they are in a same matrix component in the device; and that the relative variation in individual average diameters of the four nanowires in Kuekes can be regarded as being naturally less than

20%, as the variation in diameter in individual nanowire as shown in Fig. 6 is apparently less than 20%, and as the matrix component in Fig. 7 of Kuekes can be formed of identical nanowire-based transistors (80 or 38; see col. 9, lines 58-60)

It is also noted that the process limitations on how the recited semiconductor nanowires are made, selected and/or deposited as recited in these claims would not carry patentable weight in the claims drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

Regarding claims 44-46 and 59-61, as being supported by the elected species, the semiconductor (14) in Kuekes can be naturally extended in the matrix structure shown in Fig. 7. And, the dimension of such matrix can be naturally larger than 1 micrometer, which then naturally meets the limitation about the recited ratio being larger than 1000:1, since the diameter of the nanowire in Kuekes can be as small as about 0.1 nm (see col. 4, lines 52-54).

Regarding claims 99-101 and 106-108, insofar as being in compliance with 35 U.S.C. 112, the nanowire in Kuekes would naturally have the characteristics substantially same as that of the claimed invention, as they both have a material and dimension substantially the same to each other.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

4. Claims 6 and 8, insofar as being in compliance with 35 U.S.C. 112 and as being best understood in view of the claim objections above, are rejected under 35 U.S.C. 103(a) as being unpatentable over Kuekes.

The disclosure of Kuekes is discussed as applied to claims 1, 2, 5, 38-47, 56-72, 75, 76, 97-98, 110, 118-120, 175, 181, 183, 186-189, 191, 194, 195 and 374-377 above:

Although Kuekes does not expressly disclose that the semiconductors can also be formed of SiC, one of ordinary skill in the art would readily recognize that SiC is one of the several semiconductors most commonly used in the art, and it has better high temperature performance, compared with that of silicon, as readily evidenced in the prior art such as Morales et al. ("Morales"; Science, V279, pages 208-211; of record).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to make the device of Kuekes with the semiconductor(s) being formed of SiC, so that an electrical device with improved high temperature performance would be obtained.

Response to Arguments

5. Applicant's arguments filed 06-20-2005 have been fully considered but they are not persuasive.

Applicant's main arguments include: Kuekes does not disclose or enable the claimed invention. In response, it is noted that Kuekes does disclose the claimed

invention as the relative variation in individual average diameters of the four nanowires in Kuekes can be regarded as being naturally less than 20% in the matrix component in Fig. 7, as Kuekes teaches that they can be formed of identical nanowire-based transistors (80 or 38; see col. 9, lines 58-60) and as the variation in diameter in individual nanowire as shown in Fig. 6 is apparently less than 20%.

And, no support is found for the allegation that the nanowires in Kuekes are made through inadequate techniques of electron beam lithography and/or nanoimprint lithography. In fact, US Patent No. 6,459,095 (of record) directly cited by Kuekes specifically teaches art-known techniques to form semiconductor nanowires (see col. 6, lines 22-67 in that patent), and none of them involves the alleged inadequate techniques. Furthermore, it is noted that any implications regarding how the recited semiconductor nanowires are made, selected and/or deposited as recited in these claims would not carry patentable weight in the claims drawing to a structure, because distinct structure is not necessarily produced. In re Thorpe, 227 USPQ 964, 966 (Fed. Cir. 1985).

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not

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mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Shouxiang Hu whose telephone number is 571-272-1654. The examiner can normally be reached on Monday through Thursday, 7:30 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on 571-272-1732. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

SH
August 29, 2005


SHOUXIANG HU
PRIMARY EXAMINER